



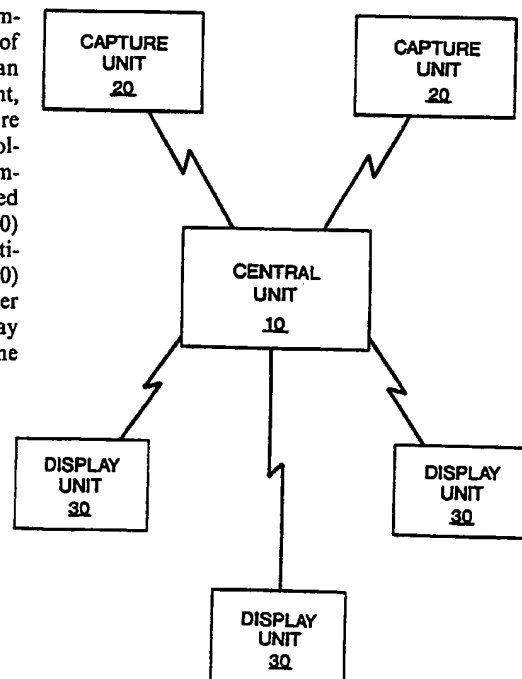
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 : G06F 15/24, G01N 21/87		A1	(11) International Publication Number: WO 93/12496
			(43) International Publication Date: 24 June 1993 (24.06.93)
(21) International Application Number: PCT/US92/10599 (22) International Filing Date: 8 December 1992 (08.12.92) (30) Priority data: 805,995 9 December 1991 (09.12.91) US (71) Applicant: GEM INTERNATIONAL NETWORK, INC. [US/US]; 1700 Broadway, Suite 1700, Denver, CO 80290-1701 (US). (72) Inventors: EZZEL, Ben, R. ; 1085 14th Street, Boulder, CO 80302 (US). BICKFORD, James, L. ; 1842 Canyon Boulevard, Apartment 211, Boulder, CO 80302 (US). GUNASEKARA, Suranjith ; 315 Arapahoe, Boulder, CO 80302 (US).		(74) Agents: CARSON, W., Scott et al.; Dorr, Carson, Sloan & Peterson, 3010 E. 6th Avenue, Denver, CO 80206 (US). (81) Designated States: AU, BB, BG, BR, CA, CH, CS, ES, FI, HU, JP, KP, KR, LK, MG, MN, MW, NO, PL, RO, RU, SD, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI pa- tent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, SN, TD, TG). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the</i> <i>claims and to be republished in the event of the receipt of</i> <i>amendments.</i>	

(54) Title: COMPUTER IMAGING SYSTEM FOR GEMSTONES

(57) Abstract

A computerized trading system provides centralized storage of images of gemstones and enables remote capture, access, and display of these images. A central unit (10) maintains a database of the images of an inventory of gemstones, together with related information, such as weight, color, clarity, and price for each gemstone. One or more remote capture units (20) (located for example at facilities where gems are cut and polished, or at wholesaler facilities) each have a camera (22) for capturing images of gemstones, and a keyboard (23) or other means for entry of related information on each gemstone. This data is relayed to the central unit (10) by a telecommunications link or by means or removable magnetic or optical media (33). The images and related data stored at the central unit (10) can be accessed and displayed via telecommunications link by a number of remote display units (30). In the preferred embodiment, each display unit (30) can also be used by buyers to place orders for gemstones with the central unit (10).



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COMPUTER IMAGING SYSTEM FOR GEMSTONES**BACKGROUND OF THE INVENTION**

5 **1. Field of the Invention.** The present invention relates generally to the field of computer imaging systems. More specifically, the present invention discloses a computer system for acquiring, storing and transmitting images and related information of gemstones to provide a network for trading of gemstones.

10 **2. Statement of the Problem.** The present invention addresses a number of shortcomings heretofore found in conventional methods of trading gemstones. The traditional approach to trading gemstones involves a face-to-face meeting between the buyer and seller to
15 give the buyer an opportunity to personally inspect the gemstones offered for sale. This approach often requires extensive travel by at least one of the parties, which can be both inconvenient and costly. In addition, there is a risk that the gemstones will
20 be lost or stolen while in transit.

Another more recent approach to trading involves delivery of gemstones by mail to potential buyers on

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a "pay or return" basis. Gemstones of a low or moderate value can be insured with the Postal Service and entrusted for delivery by registered mail with a relatively low degree of risk to the seller. However, this approach is relatively slow (since it depends upon the speed of the Postal Service) and is limited to showing the gemstones to one potential buyer at a time. Other approaches used on an informal basis by some traders include distribution of photographs of gemstones to potential buyers, and use of fax machines to distribute information on gemstones available for sale.

A number of devices and processes have been invented in the past relating to optical identification or imaging of gemstones, including the following:

	<u>Inventor</u>	<u>Patent No.</u>	<u>Issue Date</u>
	Bar-Isaac, et al.	3,947,120	Mar. 30, 1976
	Delhayé, et al.	4,030,827	June 21, 1977
20	Lang	4,125,770	Nov. 14, 1978
	Bruck	4,152,069	May 1, 1979
	Crumm, et al.	4,259,011	Mar. 31, 1981
	Ritzi	4,266,871	May 12, 1981
	Müller	4,397,556	Aug. 9, 1983
25	Bowley, et al.	4,900,147	Feb. 13, 1990

For example, Bar-Isaac, et al., Delhayé, et al., Lang, and Bowley, et al., disclose methods of mapping the crystalline structure of a gem for the purpose of identification.

Bruck discloses an optical system for determining the presence and location of inclusions within gems.

Crumm, et al., disclose an optical gem analyzer. A wide spectrum of light is passed through the gem. The internal reflections and refractions of this light are picked up and passed through different reference

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filters to analyze the quality of the gem.

Ritzi discloses an apparatus for visually duplicating the hue, tone, intensity, and shape of a selected gemstone by combining predetermined intensities of red, green, and blue light sources within a color mixing box.

Müller discloses a system for testing of materials involving comparative examination of the surface of a particular material specimen.

10 3. Solution to the Problem. None of the prior art references disclose a computerized system for trading gemstones in which images of gemstones are stored in a central database and can be accessed and displayed via telecommunications links by any of a number of
15 remote display stations.

SUMMARY OF THE INVENTION

This invention provides a computerized trading system for gemstones. A central unit maintains a database storing the images of an inventory of gemstones, together with related information, such as weight, color, clarity, and price for each gemstone. A number of remote capture units (located for example at facilities where gems are cut and polished, or at wholesaler facilities) each have a camera for capturing images of gemstones, and a keyboard or other means for entry of related information on each gemstone. This data is relayed to the central unit by a telecommunications link or by means of removable magnetic or optical media. The images and related data stored at the central unit can be accessed and displayed via telecommunications link by a number of remote display units. In the preferred embodiment, each display unit can also be used by buyers to place orders for gemstones with the central unit.

A primary object of the present invention is to provide a computerized system for trading gemstones.

Another object of the present invention is to provide a computerized system to acquire and store images of gemstones together with related data, and to allow remote retrieval and display of these images and related data.

These and other advantages, features, and objects of the present invention will be more readily understood in view of the following detailed description and the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention can be more readily understood in conjunction with the accompanying drawings, in which:

5 FIG. 1 is a schematic block diagram of the overall system.

FIG. 2 is a schematic block diagram of the central unit.

10 FIG. 3 is a schematic block diagram of a remote capture unit.

FIG. 4 is a schematic block diagram of a remote display unit.

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DETAILED DESCRIPTION OF THE INVENTION

Turning to FIG. 1., a general overview of the present system is shown. The major pieces of the system are the central unit 10, at least one capture unit 20, and at least one remote display unit 30. In summary, the central unit 10 is used to maintain a database of images and related information for an inventory of gemstones and also functions as the hub of a communications network serving the capture units 20 and the remote display units 30. Information on new gemstones to be added to the central unit's database is input via the capture units 20. Information on gemstones is retrieved from the database and displayed by the display units 30.

Central Unit. The central unit is shown in greater detail in the schematic block diagram of FIG. 2. The central unit 10 provides a database of images and related information on a large number of gemstones. The key components of the central unit 10 are a computer processor 11 with a data storage device 12, such as a magnetic or optical disk suitable for storing digital images of a large number of gemstones. In the preferred embodiment, the computer processor 11 is a personal computer (e.g. an 80386 or 80486 personal computer or other computer/database system) with a large magnetic hard disk drive (e.g. a 1.2 gigabyte hard disk). Each gemstone image can be stored in a separate file on the hard disk. In addition, the hard disk also holds a database with additional information on each gemstone (e.g. type, weight, color, cut, origin, and price). The database

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allows the central unit to maintain inventory information on available gemstones, and also permits users to query the database for gemstones meeting selected criteria (e.g. identify all sapphires in inventory between 1.0 and 1.5 carats).

One or more conventional modems 13 (e.g. Hayes Ultra 96 smart modem) allow the central unit 10 to serve as the hub for a wide area network ("WAN") in which the various capture units 20 and display units 30 are remote nodes. For example, as shown in FIG. 1, images of gemstones can be captured at any of a plurality of capture units 20 located at remote locations (e.g. facilities where gems are cut and polished, or at wholesaler facilities). These images and related information concerning the gemstones at the remote site are then transferred over a telecommunications link (e.g. telephone lines) via modem for storage by the central unit 10. A record is added to the central unit's database for each gemstone. A file is also created for each gemstone's image with an appropriate pointer or file identifier included in the database record to permit the image to be accessed in association with the database record. Alternatively, images and related information for gemstones can be transferred from remote capture units by means of other types of telecommunications links, or by transfer of removable magnetic media (e.g. floppy disk) or optical media (e.g. CD-ROM) between the capture unit 20 and the central unit 10. For example, the central unit 10 shown in FIG. 2 is equipped with a floppy disk drive 14 to accommodate the transfer of data by this means.

The central unit 10 is also equipped with a high resolution display 15 (e.g. a Sony Trinitron Multiscan

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5 HG monitor or a Sony Trinitron CPD-1302 monitor) to allow the gemstone images and related information to be viewed, verified, and edited after receipt. A computer keyboard 16 is used for editing, and for adding or updating information on individual gemstones. The central unit also has an audio interface 17 to allow a segment of music and/or voice to be recorded in association with each gemstone. In the preferred embodiment, the audio segment is converted to digital format and stored on the data storage device 12 (e.g. optical disk) of the central unit 10. Again, a pointer or a file identifier is stored in the database to allow the appropriate audio segment to be accessed and replayed in association with display of each gemstone.

15 Finally, the central unit includes software to provide essential inventory and accounting functions. This enables the central unit to process orders for gemstones and to process database queries from system users. The accounting and inventory control features provided by the central unit include:

- 25 (a) permit verification of images and related data received from each capture unit;
- (b) maintain a current inventory of all gemstones available throughout the system;
- (c) maintain a database of all authorized vendors and purchasers;
- (d) maintain records of all transactions concerning each gemstone;
- 30 (e) generate confirmation reports for each capture unit as images and related information for gemstones are received and incorporated into the central unit's database;

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- (f) generate invoices and order confirmations for orders placed by each display unit;
- (g) manage accounts receivable and collection of payments from each display unit and for the entire system;
- (h) generate shipping instructions (e.g. bills of lading, packing slips) for shipments from each capture unit;
- (i) maintain accounts payable information for each capture unit and the entire system.

As shown in FIGS. 2 and 3, a printer 18 attached to the central unit processor 11 prints these invoices, reports and other paperwork for the system. A fax 19 can be attached to the central unit processor 11 to enable direct transmission of facsimiles of images from the database with associated information on selected gemstones to remote fax machines. In addition, the central unit maintains system security by requiring passwords for each authorized vendor or purchaser.

The preceding discussion has implicitly assumed that the central unit 10 has a single computer processor 11. It should be understood that the various functions of the central unit can be delegated to a plurality of processors structured in a local area network (LAN). For example, one processor can function as a dedicated host for communications with the capture stations 20. A second processor can be used as a dedicated host for communications with the display stations 20. A third processor can be dedicated to accounting and bookkeeping functions. The configuration of the LAN can be readily rearranged (and additional processors added, if necessary) to

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accommodate the dynamic needs of the system.

Capture Unit. The capture unit 20 shown in greater detail in FIG. 3 is used to capture and initially store images of gemstones to be added to the database maintained by the central unit 10. The capture unit 20 is intended primarily for remote operation.

Operation of the capture unit is controlled by a computer processor 21 (e.g. an 80386 or 80486 personal computer). A video camera 22 (e.g. an Hitachi Z-1 video camera with a 60 mm macro lens) is connected to a videographics adapter board (e.g. a 16/32 bit Targa video board) on the computer bus. This enables the computer 21 to read an image transmitted by the video camera 22 in a digital format and to store this data as a file on the local disk drive 27 of the capture station 20. The image files created form the data output by the Targa video board have 16 or 32 bits per pixel.

The video camera 22 is mounted on a stand allowing adjustment of the distance between the camera and the gemstone. The stand also allows adjustments in the intensity and filtering of one or more light sources used to illuminate the gemstone. In the preferred embodiment, the stand has a translucent non-reflective surface to support the gemstone with image reference lines.

The capture unit 20 also has a conventional DOS monitor 25, a keyboard 23, and a mouse 231 to permit the operator to control operation of the capture unit, and for manual entry of additional data (e.g. type, color, weight, cut, clarity, price) for each gemstone. A second, high resolution display 25 is used to verify and edit the gemstone images produced by the video

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video camera 22. This information is read by the computer processor 21 and stored on the disk 27 in association with the appropriate image file for each gemstone. Optionally, an electronic scale 24 (e.g. a
5 Mettler CM200 scale with 0.001 carat precision) attached to the computer bus can be employed to automatically provide the computer processor 21 with the weight of each gemstone.

After the capture unit 20 has stored the images
10 and related information for a number of gemstones, this data is transmitted to the central unit 10 for incorporation into the central unit's database. Transmission of this information can either be accomplished over a telecommunications link (e.g. over
15 telephone lines, or dedicated fiber optic lines) via modem 26, or by physical transportation of removable media 28 (e.g. by floppy disks or a removable optical disk) containing the data from the capture unit 20 to the central unit 10. In order to reduce the amount of
20 data transmitted to and stored by the central unit 10, the computer processor 21 of each capture station 20 uses data compression software (e.g. PKZIP.EXE, a public domain file compression utility program) to compress each file before it is transmitted to the
25 central unit 10. This step can result in a 4-to-1 to 20-to-1 reduction in file size.

The capture unit 20 should maintain a log of the information on each gemstone transmitted to the central unit 10. The capture unit 20 can also be
30 employed to maintain inventory and accounting information. A printer 29 is therefore attached to the capture unit to print the log and any required inventory or accounting reports.

In addition, a label printer attached to the

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capture unit's processor can be used to print an adhesive label bearing a unique bar code for each gemstone. This bar code label is affixed to the plastic bag or other container holding the gemstone.

5 A bar code reader connected to the computer processor can then be used to scan the labels of all gemstones shipped from the capture unit to verify the accuracy and completeness of all shipments. The bar code reader can also be used to rapidly scan the labels of

10 all gemstones in inventory at the capture unit for verification against the inventory data maintained by the computer processor.

The preceding discussion has assumed that the capture unit 20 is geographically remote from the central unit 10. Although this is a significant feature of the present system, it should be expressly understood that the capture unit 20 can be combined in a single facility with the central unit 10. Furthermore, a video camera can be directly interfaced

20 to the central unit's processor 11 to effectively yield many of the same capabilities in a single unit.

Display Unit. FIG. 4 provides a schematic block diagram of a typical remote display unit 30. Once again, a computer processor 31 (e.g. an 80386 or 80486 personal computer) controls the display unit 30. A

25 modem 32 is employed for communications with the central unit 10 over a telecommunications link. Images and related information for gemstones can be retrieved from the central unit's database, stored on the display units hard disk 37, and displayed on a

30 high resolution display monitor 38.

The display unit 30 includes software to create a user-friendly interface to access the central unit

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10; browse the database of available gemstones in the central unit's database; submit queries to the central unit to select gemstones meeting certain criteria; retrieve and display images of selected gemstones from the database; and submit purchase orders to the central unit. This user interface will typically include a computer keyboard 35, a mouse 39, and a conventional DOS monitor 34 to provide user-friendly graphical interface to control operation of the display unit. In the preferred embodiment, a second high-resolution monitor 38 (e.g. a Sony Trinitron Multiscan HG monitor or a Sony Trinitron CPD-1302 monitor) is interfaced to the processor bus by a Targa videographics board, and is used to display the gemstone images retrieved by the display unit 30 from the central unit 10. As an alternative embodiment without a second monitor, a suitable display unit can be made by minor modifications to a laptop personal computer, such as a Toshiba T5200 or T5100 laptop computer equipped with a DAC graphics board.

The display unit 30 can be equipped with an audio card connected to the computer bus, a digital-to-analog converter, and a speaker 36 to enable the display unit to play back a segment of audio data (music and/or voice) retrieved from the central unit's database for each gemstone.

It has previously been mentioned that the image files can be compressed by the capture stations 20 before transmission to the central unit 10. It may also be desirable to similarly compress the files containing the audio segment and other information associated with each gemstone. To the extent such data has been compressed either by the capture unit 20 or the central unit 10, the display unit must reverse

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this process (i.e., uncompress) the files received from the central unit before the data can be used by the display unit. This can be accomplished by software, such as the public domain utility known as
5 PKUNZIP.EXE.

The preferred embodiment of the display unit 30 allows rapid two-way communications between each display unit 30 and the central unit 10 via telecommunications links as shown in FIG. 1. This may
10 not be technically or economically feasible in some situations. Hence, an alternative embodiment of the display unit 30 minimizes (or completely eliminates) use of the telecommunication link by relying on
15 removable media 33 (e.g. tape cartridges, floppy disks, removable magnetic disk cartridges, CD-ROM, or removable optical disks) for distribution of copies of the central unit's database of images and related information to each display unit. Each display unit
20 30 can then query and view gemstone images from its own local copy of the database. Orders for gemstones can be placed with the central unit 10 by means of a telecommunications link as before, or by mail, fax, or telephone call. Updated copies of the entire database or selected portions of the database can be
25 distributed from the central unit to each display unit on a periodic basis to reflect changes in inventory, pricing, etc.

The above disclosure sets forth the preferred embodiment of the present invention. Other
30 arrangements or embodiments, not precisely set forth, could be practiced under the teachings of the present invention and as set forth in the following claims.

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WE CLAIM:

1. A system comprising:
 - camera means for capturing images of gemstones;
 - data entry means for entry of information on
 - 5 each of said gemstones;
 - a central unit having:
 - (a) data storage means for storing said images and information;
 - (b) order processing means for processing
 - 10 orders and maintaining inventory information for said gemstones; and
 - (c) means for remote communication of said images and information stored by said data storage means; and
 - 15 at least one remote display unit having:
 - (a) communications means for receiving said images and information on selected gemstones from said central unit; and
 - (b) display means for displaying said
 - 20 images and information.
2. The system of claim 1 wherein said remote display unit further comprises means for entering and communicating orders for selected gemstones to said central unit.
3. The system of claim 1 wherein said camera means and said data entry means are part of a remote capture unit connected to said central unit by means of a telecommunications link.

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4. The system of claim 1 wherein said communications means between said remote display unit and said central unit comprises a telecommunications link.

5. The system of claim 1 wherein said communications means between said remote display unit and said central unit comprises the transfer of a removable magnetic media.

6. The system of claim 1 wherein said communications means between said remote display unit and said central unit comprises the transfer of a removable optical disk.

7. The system of claim 1 wherein said data entry means comprise an electronic scale to record the weight of each gemstone.

8. The system of claim 1 further comprising:
data compression means for reducing the amount of data necessary for said data storage means to store the image of each gemstone; and

5 data decompression means associated with each remote display unit for recreating said images from said compressed data.

9. The system of claim 1 wherein said data entry means comprise means for recording audio data in association with each gemstone; and wherein said remote display unit further comprises means for
5 playing back said audio data as said image is being displayed.

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10. A system comprising:
a central unit having:
(a) data storage means for storing images
and related information on a plurality of gemstones;
5 (b) order processing means for processing
orders and maintaining inventory information for said
gemstones; and
(c) means for communication of said images
and related information;
10 at least one capture unit having:
(a) camera means for capturing images of
gemstones; and
(b) data entry means for entry of
information on said gemstones; and
15 (c) means for delivering said images and
information to said central unit for storage by said
data storage means; and
at least one remote display unit having:
(a) display means for retrieving and
20 displaying images and related information for selected
gemstones from said central data storage means; and
(b) means for placing orders for said
gemstones with said central unit.

11. The system of claim 10 wherein said remote display unit is connected to said central unit by means of a telecommunications link.

12. The system of claim 10 wherein said capture unit further comprises a scale to record the weight of each gemstone.

13. The system of claim 10 further comprising:
data compression means associated with said

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capture unit for reducing the amount of data necessary
for said data storage means to store the image of each
5 gemstone; and

data decompression means associated with
each remote display unit for recreating said images
from said compressed data.

14. The system of claim 10 wherein said central
unit further comprises means for recording audio data
in association with each gemstone; and wherein said
remote display unit further comprises means for
5 playing back said audio data.

15. A system comprising:
a central unit having:
(a) data storage means for storing images
and related information on a plurality of gemstones;
5 (b) order processing means for processing
orders and maintaining inventory information for said
gemstones; and
(c) telecommunications means for
communication of data;
10 at least one capture unit having:
(a) camera means for capturing images of
gemstones;
(b) data entry means for entry of
information concerning said gemstones; and
15 (c) telecommunications means for
transmitting said images and said information to said
central unit for storage by said data storage means;
and
at least one remote display unit having:
20 (a) display means for displaying images and
related information for selected gemstones;

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(b) data entry means for placing orders for selected ones of said gemstones; and

(c) telecommunications means for receiving
25 images and information from said central unit, and for
communicating data regarding said orders with said
central unit.

16. The system of claim 15 wherein said capture unit further comprises an electronic scale to record the weight of each gemstone.

17. The system of claim 15 further comprising:
data compression means associated with said
capture unit for reducing the amount of data necessary
to transmit the image of each gemstone to said central
5 unit; and

data decompression means associated with
said remote display unit for recreating said images
from said compressed data.

18. The system of claim 15 wherein said central unit further comprises means for recording audio data in association with selected ones of said gemstones; and wherein said remote display unit further comprises
5 means for playing back said audio data.

19. A system comprising:
a central unit having:

(a) data storage means for storing images
of a plurality of gemstones in the form of electronic
5 data, in association with related information
concerning each gemstone;

(b) order processing means for processing
orders and maintaining inventory information for said

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gemstones; and

10 (c) a modem for communication of data over
telephone lines;

at least one capture unit having:

(a) camera means for capturing images of
gemstones in the form of electronic data;

15 (b) data compression means to compress
said image data;

(c) data entry means for entry of related
information concerning said gemstones; and

(d) means for delivering said compressed
20 image data and said related information to said
central unit for storage by said data storage means;
and

at least one remote display unit having:

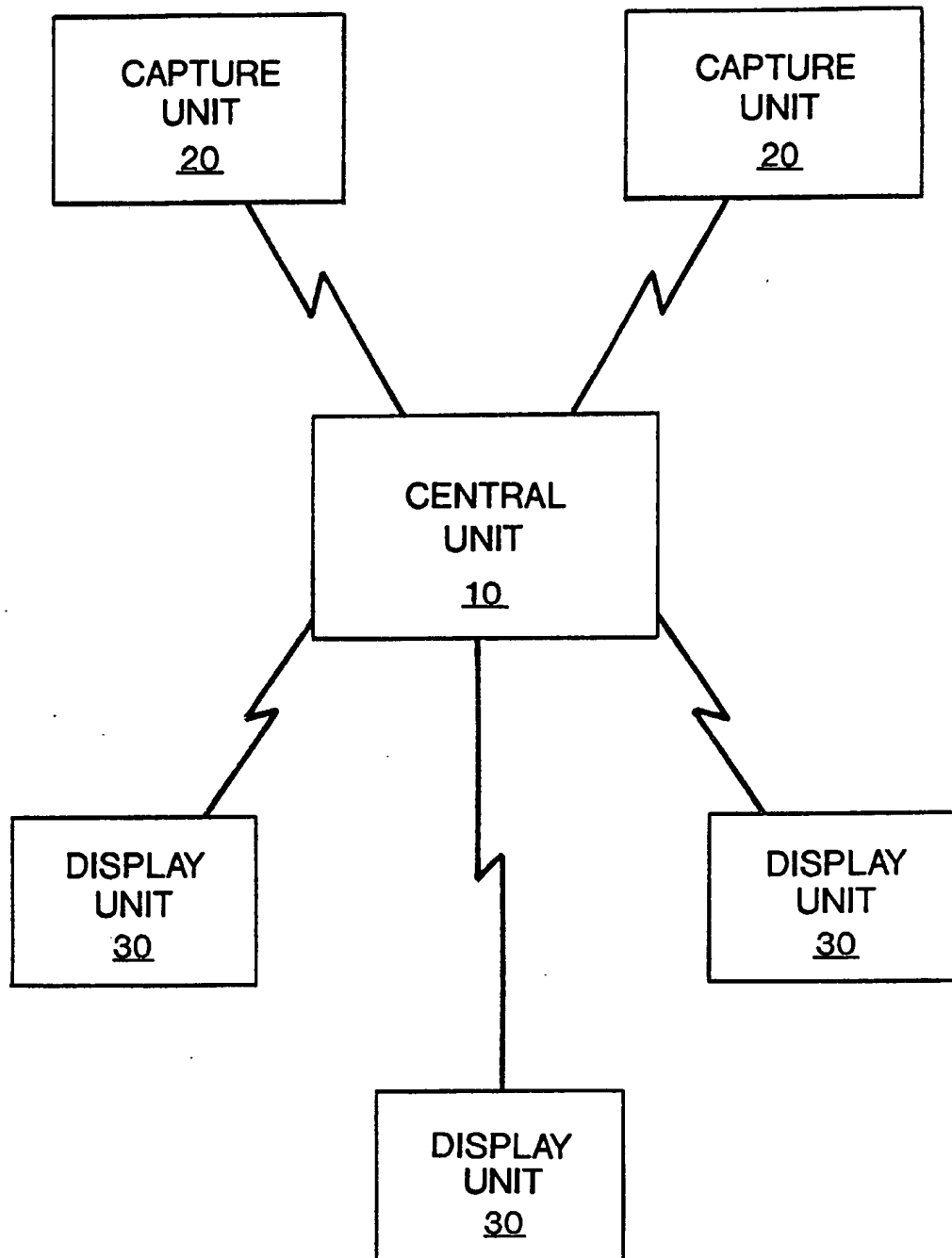
(a) a modem for communication of data with
25 said central unit;

(b) data decompression means for recreating
an image from said compressed image data received by
said modem;

(c) display means for displaying said image
30 and related information for a selected gemstone; and

(d) data entry means for placing an order
for a selected gemstone with said central unit.

20. The system of claim 19 wherein said central
unit further comprises means for storing audio data in
association with each gemstone; and wherein said
remote display unit further comprises means for
5 playing back said audio data as the gemstone image is
being displayed.

Fig. 1

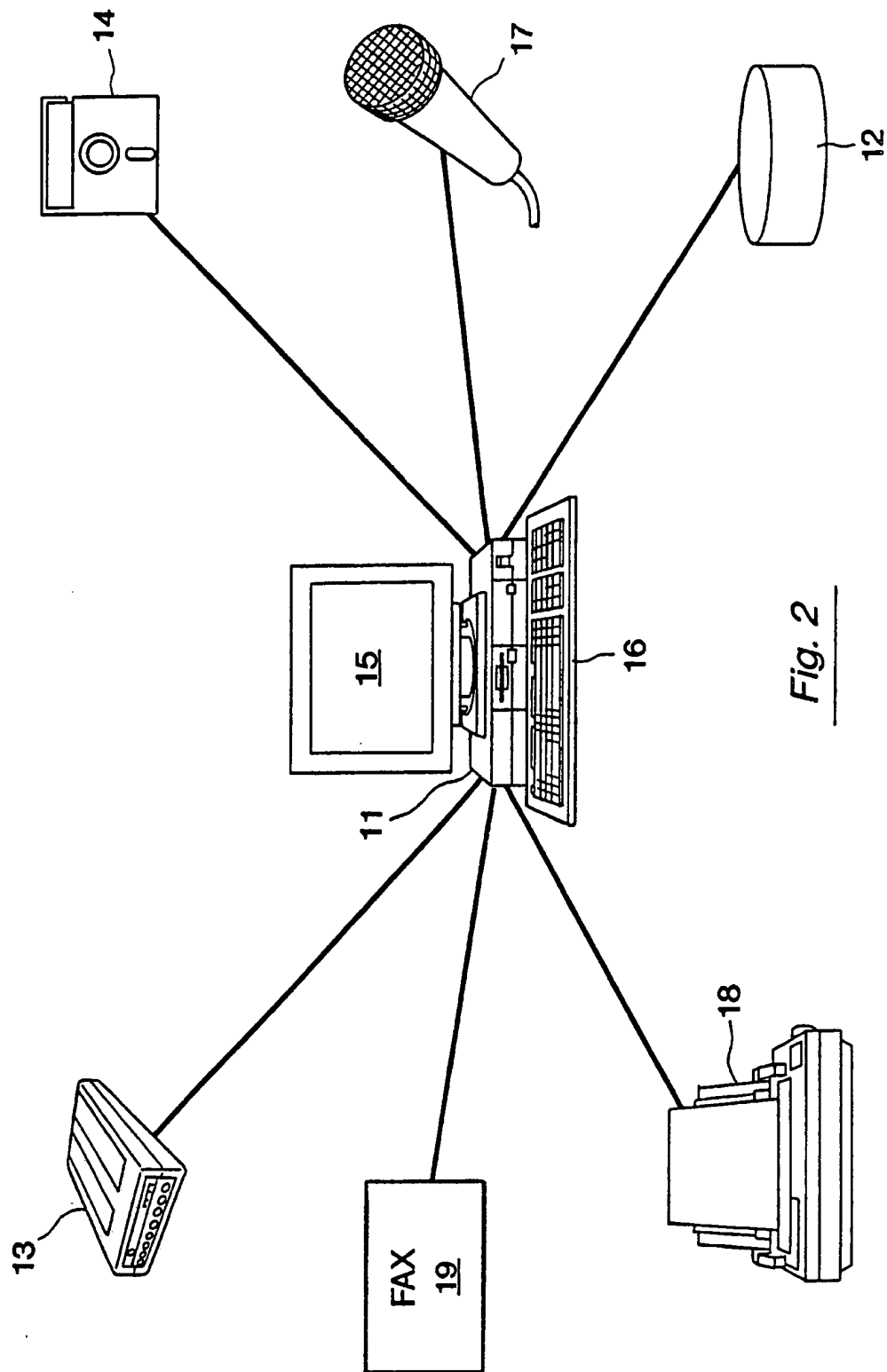
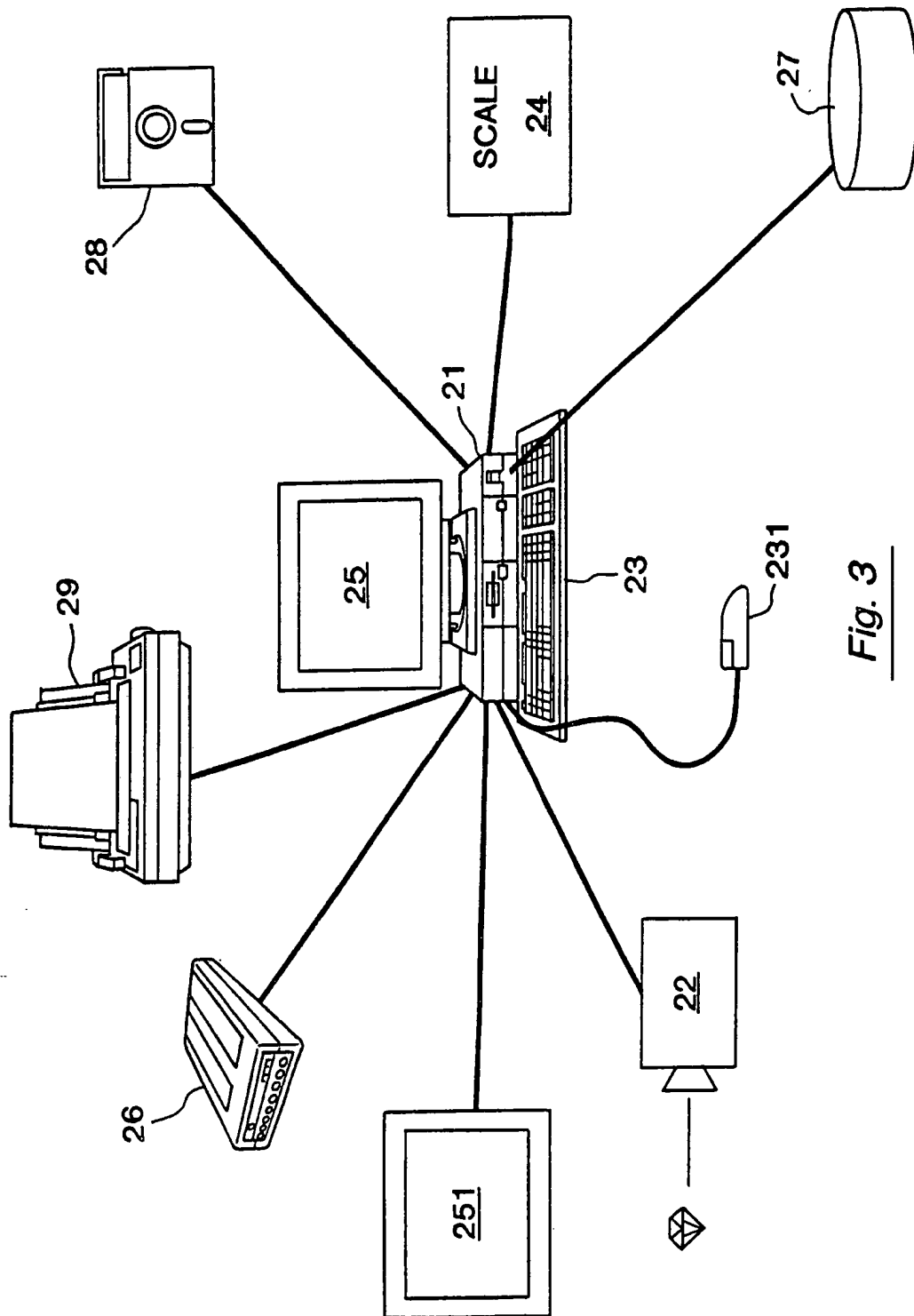
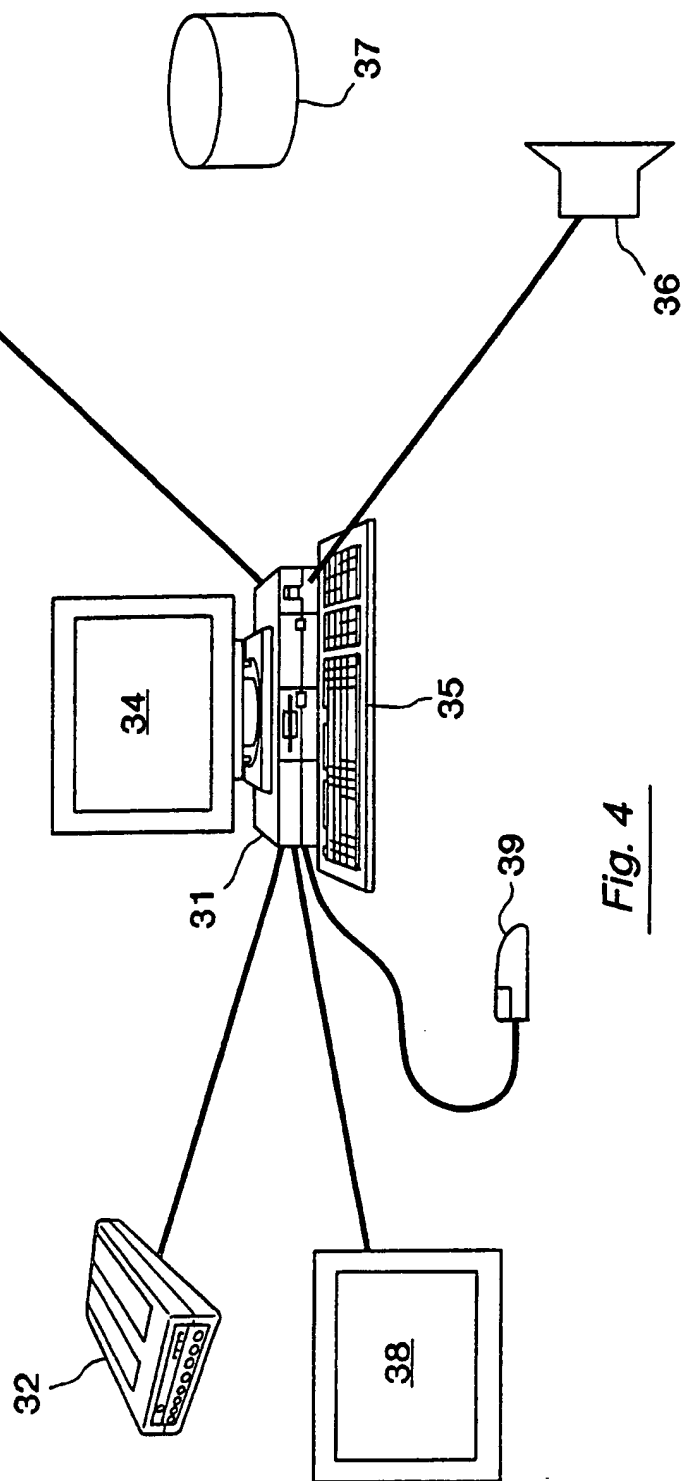


Fig. 2

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Fig. 4

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 92/10599

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) ⁶		
According to International Patent Classification (IPC) or to both National Classification and IPC		
Int.Cl. 5 G06F15/24; G01N21/87		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
Int.Cl. 5	G06F ; G01N ; G07F ; G09F	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸		
III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹		
Category ¹⁰	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
X	GB,A,1 416 568 (SHELDON SEYMOUR WILSON) 3 December 1975 see page 1, line 10 - line 47	1-7, 10-12,15
A	see page 2, line 97 - page 4, line 84 ---	9,14,19
X	FR,A,2 496 888 (GEMOLOGICAL LABORATORY OF ANTWERP) 25 June 1982	1-4, 10-12,15
A	see page 8, line 17 - line 35 ---	5,7,9, 16,19
P,X	WO,A,9 209 882 (OMPHALOS RECOVERY SYSTEMS) 11 June 1992 see the whole document ---	1,3-7, 10-12
A	EP,A,0 368 475 (COATS VIYELLA PLC) 16 May 1990 see the whole document ---	1-20
-/--		
¹⁰ Special categories of cited documents : ^{"A"} document defining the general state of the art which is not considered to be of particular relevance ^{"E"} earlier document but published on or after the international filing date ^{"L"} document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) ^{"O"} document referring to an oral disclosure, use, exhibition or other means ^{"P"} document published prior to the international filing date but later than the priority date claimed ^{"T"} later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention ^{"X"} document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step ^{"Y"} document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. ^{"&"} document member of the same patent family		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
29 MARCH 1993	14. 04. 93	
International Searching Authority	Signature of Authorized Officer	
EUROPEAN PATENT OFFICE	GUIVOL O.	

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